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Keep Your Tile Drains Working

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LEAFLET NO. 347

KEEP YOUR TILE DRAINS WORKING

By Paul Jacobson, *zone conservationist, Upper Mississippi Region, Soil Conservation Service*

Tile drains properly installed need only slight care to keep them working. Many tile drains have been in use for 20 to 30 years, and if cared for, will continue to give good service.

Unfortunately some tile lines do fail, and usually the failure could have been prevented by easy regular care.

In some fields holes in tiles let every rain wash soil into the line. Small animals or tree roots sometimes stop up tile lines, and trampling by livestock often dislodges and breaks tiles.

Many outlet ditches have silted so badly that the tile outlet is completely filled up. A too shallow outlet ditch also can force the water back into the tile.

Washouts occur regularly where the gaps are too wide between the tile sections or where junctions are not properly made.

One reason for all this is that farmers don't know where their tile lines are. When some tile systems were installed, no map showing location of the tile lines nor record of size or of grade was kept.

How To Tell Drains Are Working

You know your tile drains are working if, after heavy rains, water remains on your field for only a short time. Should water stand in low areas for a few days then your tile is partly or completely blocked. Wet spots in your field also show that water is not being carried off. These spots usually appear over stopped-up lines.

A hole or cave-in above a tile line frequently indicates a broken or displaced tile.

If your tile system has inspection wells, silt wells, or manholes, watch these and the outlets after heavy rains to check the amount and time of flow. Any change in either indicates a stoppage somewhere in the line.

To check on a long line, dig inspection pits every 100 to 250 feet. This distance can be increased if the water is flowing freely. Obstructions between pits are easily found by using a mirror and a flashlight.

Suppose your line is partly filled. To check, first block the next tile upstream to stop the flow. Then pour water in the upper pit and watch the time it takes to reach the next pit. A line is partly filled if the tile becomes more than half full and the water moves sluggishly.

Generally, water should move through a 4- to 6-inch tile, flowing full, at about 1 foot per second when tile is laid on a grade of 0.1 to 0.15 foot per 100 feet. Flowing part full, the rate is somewhat slower.

Clean Outlets

Many an otherwise good tile-drainage system has failed because of carelessly kept outlet ditches. If your outlet ditch is filled up, a survey will help you find out just what is needed. Make this survey on all jobs regardless of size.

To make this survey on small jobs, set up an engineer's level and take a reading at the end of the tile line. Then take readings every 100 feet down the outlet ditch until you find a point low enough to provide satisfactory flow. Usually, if the distance is 400 feet or less, a point a couple of feet lower than the end of the tile is low enough.

Figure 1.—Dragline being used to clean out an open ditch to provide outlet for tile drains.

Figure 2.—Surface inlets provide an effective way of removing ponded surface water, but intake covers must be cleaned frequently.

If your job is a major one, you will need the assistance of an engineer to make this survey. You can get this help through your local soil conservation district.

After you have found out how much work is needed, choose some method of cleanout. There are several methods to pick from:

1. A ditch-blasting job:

On ditches where removal of only a foot or two of silt for a few hundred feet is necessary and where the sides of the ditch are stable, the cheapest method is probably by blasting. This can be done by the propagation method. In this method charges are spaced close enough that the detonation of one automatically explodes the next until the whole series is set off.

If ditch blasting is to be economical, a saturated soil is absolutely necessary.

Blasting is dangerous and no one but a person experienced in such work should ever undertake it.

2. Scraper cleanout:

A cheap way to remove small shoals or sand or silt bars is with a slip scraper. If the ditch is dry and the side slopes are not too steep, attach a scraper directly to the tractor and remove the shoal by working across the ditch. Generally where side slopes will not permit crossing the ditch you can operate the equipment on top of the bank and use a cable to pull the scraper.

3. Dragline cleanout:

If your survey shows that a lot of excavation and bank-sloping work is needed to restore your outlet, you probably will need a dragline (fig. 1).

For drainage work, draglines usually range in size from ⅜ to 2½ cubic yards and are normally owned and operated by contractors. These contractors are easily accessible in most localities where drainage work is done. For further information see USDA Farmers' Bulletin 2047, Maintaining Drainage Systems.

If stoppage is caused by an outlet not under your control, the first step, obviously, is to find out who owns it. It may be the property of a legally organized drainage district, or several landowners may be involved.

Maintenance laws will control the methods of cleanout if the outlet belongs to a district. These laws, of course, differ from State to State. Your local soil conservation district can tell you whether the outlet is in a legal district and what cleanout methods to use.

On outlets not in a legal district and where several landowners are involved, a mutual agreement should be drawn up. The agreement should provide that all members of the group, as well as equipment, have access to the outlet to repair it should the landowner neglect to do so.

It should also include methods of care, annual cost estimates, the amount and type of work each group

Figure 3.—Blowouts sometimes occur on tile lines. Prompt repair is necessary to prevent large quantities of soil from being washed into tile lines.

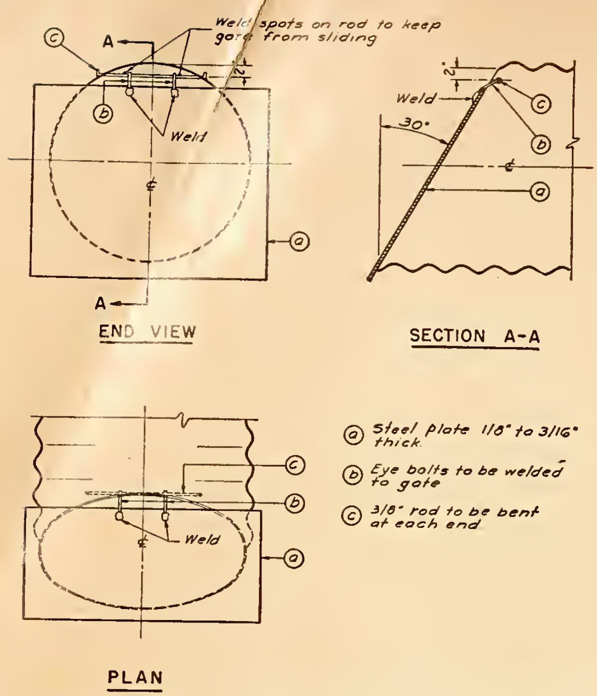
Weld spots on rod to keep gate from sliding
A
c
b
Weld
a
A
END VIEW
Weld
30°
c
b
a
SECTION A-A
c
b
Weld
a
PLAN
a Steel plate 1/8" to 3/16" thick
b Eye bolts to be welded to gate
c 3/8" rod to be bent at each end

Figure **4.—Plans for flap gate at the outlet to prevent small animals from entering the tile line. This gate can also be made up of rods.**

member is to perform, the time it is to be done. and the estimated annual cash contributions each member is to make. It is also wise to have recorded right-of-way easements in the event ownership changes so that the outlet always is accessible to all parties involved.

Surface Inlets

Poorly constructed surface inlets are subject to severe damage and require frequent repairs. If holes have washed around the inlet, dig a trench for about 8 to 10 feet along the tile line on each side of the inlet. This will expose the tile line so that you can pour concrete around the tile to seal the joints. Then excavate under each joint and place mortar completely around the joint, sealing it both on the top and bottom.

Often the intake covers become sealed over with trash. You will need to check them frequently if the inlets are to remove the ponded water (fig. 2). If necessary, clean the covers after every big rain, and always be sure to replace the covers. If left off, a large rain may wash trash into the lines which would then require extensive work to repair the system.

Where there is a wet spot in the center of a field a blind inlet can be used to remove the water. Usually such an inlet is made by filling a section of the trench with crushed rock, gravel, corncobs, or other material that will not pack and that lets water through freely. After several years this porous section may fill with silt and no longer let water to the tile line. You can dig it up and refill the trench with fresh filler. Or, if the original material was coarse gravel or rock, open up a new trench over the line. This should always be in the lowest elevation in the wet spot. To be effective, the filled section of trench should be at least a rod in length. For further information see USDA Farmers' Bulletin 2046, Farm Drainage.

Repair Blowouts

Holes often appear over tile lines (fig. 3). You should repair these at once or large quantities of soil will wash into the lines and may destroy the entire system. To locate the trouble, dig a good-sized hole down to the tile. Quite often holes like these develop over tile junctions not well cemented. If this is true, mix equal parts of sand and cement, and cement around the tile, filling up all holes where soil can get into the tile. Sometimes broken tile or too wide joints cause holes. If the cause is broken tile, replace the tile. If the joints are too wide, place tile bats (broken pieces of tile) over

Figure **5.—Pins inserted in pipe outlet to prevent small animals from entering the tile line.**

Figure 6.—Gully started by unprotected tile outlet.

the wide joint to prevent soil from washing into the tile.

Check Sand Traps and Catch Basins

Where tile lines are laid in sand, usually sand traps or catch basins are built to catch the sand. But traps will not keep sand from filling tile lines unless you keep the traps clean. Check them every few days when lines are first laid, as a lot of fine sand will wash in through the joints. Later on sand will wash in more slowly; then you need to check the traps only once or twice a year. In fact, you can notice how often the traps fill with sand and set up a schedule indicating when they will need cleanout.

Control Small Animals

Tile outlets should be protected against small animals. One way is to use a flap-type outlet. You can obtain several kinds from dealers in corrugated pipe.

A simple device can be made at home. The end of a pipe is first cut off on a 30-degree angle. Then using a piece of one-eighth-inch thick sheet-metal steel cut a circular flap large enough to extend well beyond the sides and bottom of the pipe. Trim the top of the flap to permit easy opening and fold back the edges for rigidity. Finally fasten the flap to the pipe at the top with large. loose wire links. Another effective type is shown in figure 4.

For lines without surface intakes, insert pins not more than 1½ inches apart through the end of the pipe to make a screen (fig. 5). This must be checked frequently to keep roots carried by the water from filling up the openings between the bars.

Control Tree Roots

If tile lines are not functioning, if no holes appear on the lines, and if the outlets are open, check for trees in the vicinity of the lines. This is especially needed if these are elms, willows. or cottonwoods. To get moisture, the roots of these trees will often go a hundred feet or more to a tile line, and then will eventually plug up the line.

To merely repair the line you can dig it up, clean out the roots, and then relay it.

A permanent way to keep the line working is to kill the trees by girdling. Another is to replace a part of the line close to the trees with sewer tile. and then carefully mortar the joints. If killing the trees is necessary, girdling is best done in August.

Figure 7.—This erosion was caused. by water running underneath the outlet pipe because of poor backfilling and unsealed pipe end. The soil should be carefully tamped when the outlet is installed.

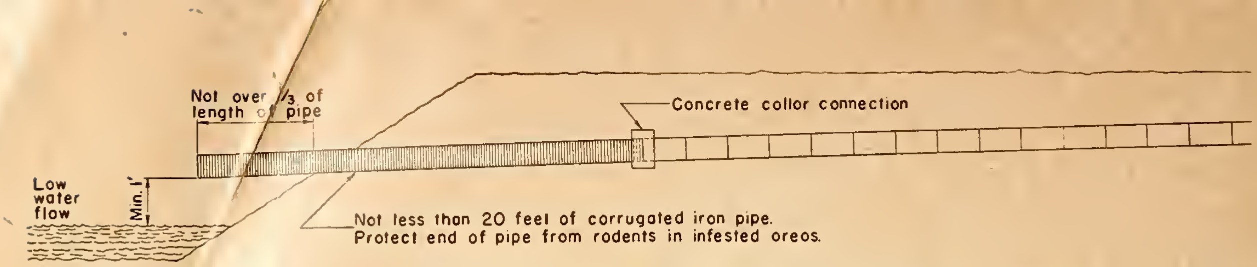
Not over 1/3 of length of pipe
Concrete collar connection
Low water flow
Min. 1'
Not less than 20 feet of corrugated iron pipe.
Protect end of pipe from rodents in infested areas.

Figure 8.—A drainpipe outlet. Increase the grade of the outlet pipe if necessary to reduce height of discharge into the ditch. The pipe should be 2 inches larger than the tile.

Keep Outlet Structures Intact

Gullies are often started by unprotected tile outlets (fig. 6). Repair of this particular damage then is necessary to protect the field from the gully and the ditch from silting.

The best and cheapest method is a pipe outlet if the surface water enters at another location. These outlets should be carefully built. A common cause of failure of this outlet is water running underneath (fig. 7). Figure 8 shows how a good outlet can be made. The pipe—2 inches wider than the tile—should be slipped

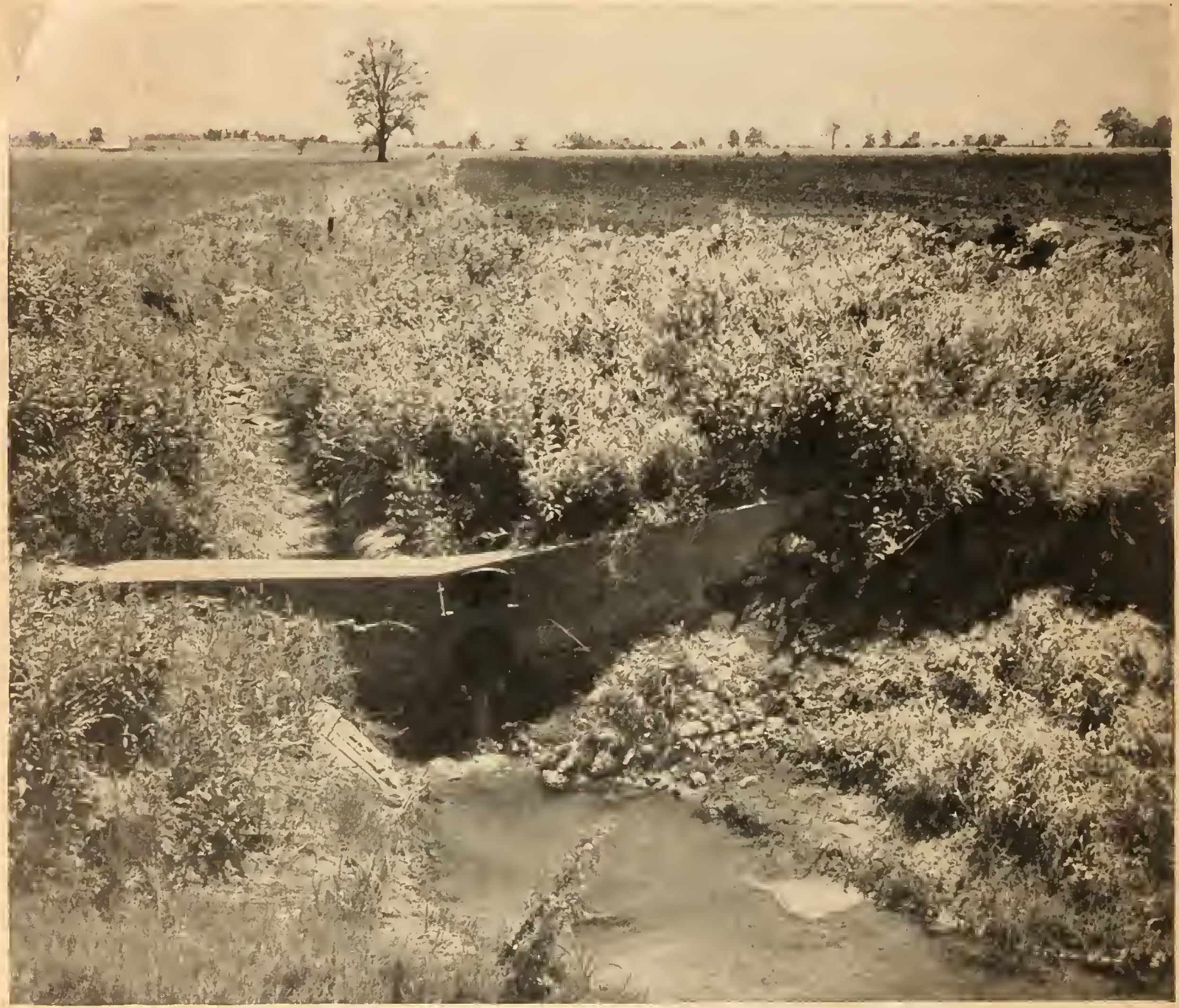

Figure 9.—This shows what can happen when a headwall is not designed properly. The notch is not big enough. The concrete is not deep enough below the tile and this allowed surface water to eat under it.

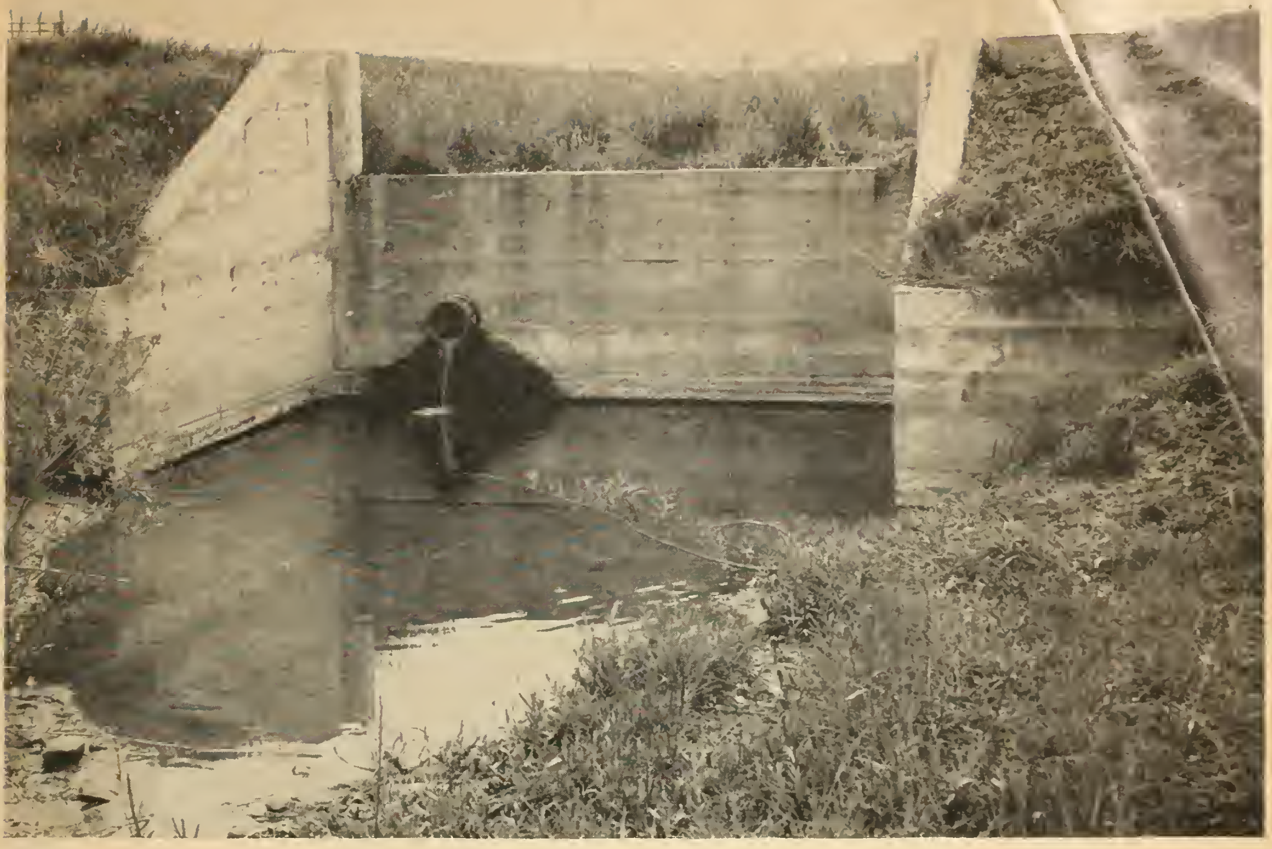

Figure **10.—Notch spillway dams furnish protection to tile outlets and provide a means for large quantities of water to enter the ditch without causing erosion.**

over the last tile and fastened with a concrete collar connection. Also the pipe should extend beyond the ditchbank so that the water will drop without eroding the bank. If this outlet is in clay soils and if you do a good job of tamping of the earth supporting it, a concrete supporting block and collar is not needed. Otherwise it is well to have one.

Where you have both surface and tile water emptying into the ditch at the same place, you need a structure that is a major engineering job (fig. 9). Your local soil conservation district technician can help you. You can use either a notch dam (fig. 10) or a pipe that will carry both surface and tile water.

Keep Up Waterways Over Tile Lines

If the fall of a waterway is more than 1½ to 2 percent, lay tile on each side of the waterway rather than one line down the middle. This prevents damage to the tile system should gullying develop in the waterway. It also stops surface water from finding a small hole into the tile line, which often happens if the tile is laid in the center of the waterway. When this occurs, the water will carry soil, and eventually a large hole instead of a small one will be washed over the tile line.

For methods of seeding waterways see USDA Leaflet 257, Grass Waterways.

Use Crop Rotations

Quite often a drainage system fails over a whole field. On digging down to the tile, it is found clean, yet little water is flowing through it. Probably the cause is broken-down soil tilth. Thus water is prevented from reaching the tile. Crop rotations must contain enough legumes and grasses to keep the soil tilth in condition to allow penetration of water. To have good tilth, the length of time the land must be kept in meadow depends on the kind of soil. You can obtain information on crop rotations from the Soil Conservation Service technician in your local soil conservation district or from your county agent.

Find and Make a Map of Your Tile System

To have a really effective drainage maintenance program you must know exactly where your tile is laid.

The most practical method for finding your tile lines is with a probe, with a soil auger, or by digging. You can easily make a probe by welding a handle and a ½-inch ball bearing on a tool-steel rod ⅜ inch in diameter (fig. 11). Push the probe downward in the soil, and frequently pour water in the hole while you are probing. The probe cannot be used in soils with hardpan or gravel. Here you will have to resort to digging.

Another way to find your lines is to watch the plow furrow when plowing the field. If there is a marked difference between the color of the subsoil and surface soil, the trenches will quite often show up in the bottom of the plow furrow. If you drive stakes at intervals as you locate your lines, the drainage pattern will form.

You can also examine the ground when the field is plowed right after a rain just as it first begins to dry. The soil directly over the tile line will dry out first, and this outlines your tile lines.

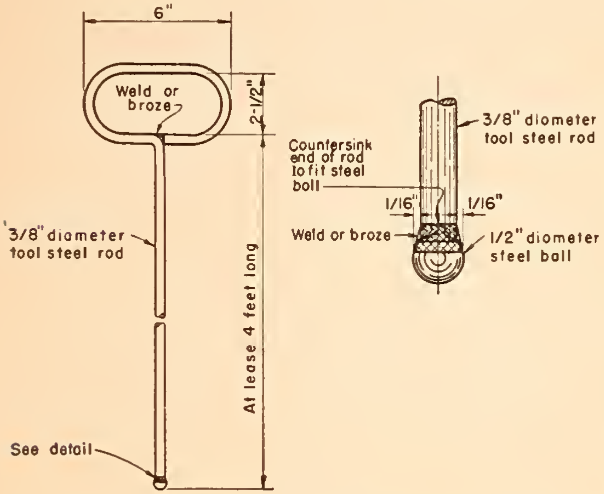

Figure 11.—Plan for constructing a tile probe which is valuable in locating tile. On some soils it may work better to use a ⅝-inch steel ball instead of the ½-inch ball shown.

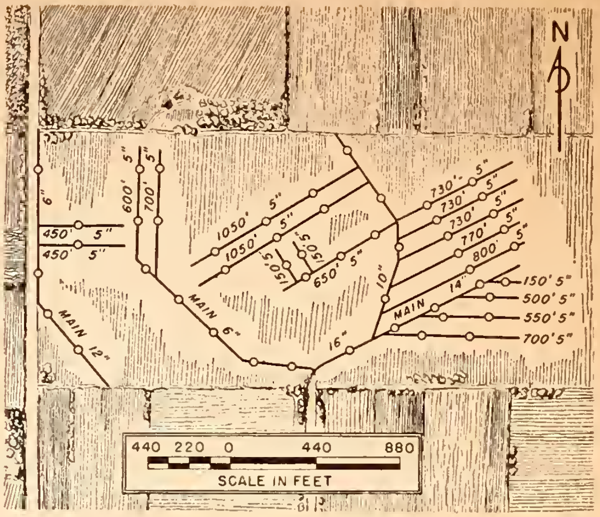

Figure 12.—An aerial photograph used as a base map and location of tile lines drafted on to scale. A map of a tile system will furnish one of the most valuable guides in future maintenance work.

A further aid in finding your lines is to watch your grain crops at ripening time. The grain sometimes stays green over the lines a day or two longer.

Aerial photographs are also a means of tracing your lines as they often show up on them. These photographs are available at the local headquarters of the Soil Conservation Service.

It may take several years to find all of your tile lines. But this can be done while you are farming your land, and as the lines are located, you can record them on a map. In this way you will develop a tile map for your farm.

If you plan to buy a farm, it is well to obtain all the information you can on tile-line location from the owner. Then you can plot the information on a sketch map, and this will aid you materially in finding the tile lines when they need checking or if tile lines are added in the future. When you actually trace the lines, you can map them to scale on an aerial photograph (fig. 12).

Another value of such a map is that it will be evidence of your capital investment in drainage if your farm is sold.

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